

# Focus on Research



NHDOT

Summer 2010

## NHDOT RAC Prioritizes New Problem Statements

The NHDOT Research Advisory Council (RAC) met on April 21st at the New Hampshire Higher Education Assistance Foundation (NH HEAF) in Concord. The RAC plays a key role in evaluating and prioritizing research problem statements submitted for funding consideration through the SPR Research program. The Council is comprised primarily of Bureau Administrators representing the major divisions of the Department. Both highway and non-highway transportation modes are represented.



This year, problem statements were submitted and presented by the Bureaus of Highway Design, Traffic, Aeronautics, and Materials in Research, along with a joint submittal from Rail & Transit and the Office of Stewardship & Compliance. In addition, several University of New Hampshire faculty collaborated with Department personnel to develop problem statements in their area of expertise. An initial literature search and screening process conducted by Research staff prior to the meeting resulted in a total of 13 problem statements presented for consideration. The top 5 ranked topics are outlined in the box below.

Findings from two recently completed research projects were also presented to RAC members. The USGS NH-VT Water Science Center presented results from their study providing updated estimates for flood discharges in New Hampshire streams. A web-based application called StreamStats was developed through the project. A second presentation summarized the results from research conducted to develop mix proportioning and materials guidelines for self-consolidating concrete (SCC).

### Top-Ranked New Research Projects April 2010

1. Performance of High - RAP Pavement Sections in NH
2. Identification of Curve Characteristics on Rural NH Roads for Cost Effective Safety Improvements
3. Alternative Technologies for Monitoring Compaction on NHDOT Projects
4. Establishing Limits for Supplementary Cementitious Materials in Durable PCC
5. Development of a Performance-Based Specification for Waterborne Traffic Paint

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## Performance of High-RAP Pavement Sections in NH

The use of reclaimed asphalt pavement (RAP) in hot mix asphalt is routine in New Hampshire. However, the amount of RAP has typically been limited to the 15-20% range due to a lack of experience and understanding of mixtures containing higher amounts of RAP. Dwindling sources of raw materials, the increasing price of liquid asphalt, and the recognition of the need to practice sustainable techniques in roadway construction have lead NHDOT and local contractors to pursue the use of higher percentages of RAP on state projects.

### New Research

Additional research and study of high RAP mixtures in NH is necessary to establish the best practices and procedures to ensure equal or better performance than mixtures currently being used. A milling and resurfacing project is underway on I-93 between Exits 30 and 32 in Woodstock and Lincoln. This section of highway was built with a high RAP (35% RAP) pavement section in the late 1980's and is one of the only sections of roadway of its age in the nation with such a high RAP content. Millings collected from the northbound barrel in 2010 will be incorporated as RAP in the pavement mixes for resurfacing the southbound lanes in 2011.

The existing high-RAP section has been in place for over 20 years and has performed well. A forensic evaluation of this pavement and a comparable pavement containing virgin materials will provide valuable insight into material properties of high RAP mixtures that perform well in NH. The existing pavement conditions will be evaluated and a characterization of mixture properties will occur. Guidance for the future use of high RAP mixtures to the NHDOT will result in potentially saving significant money on pavement construction and maintenance.



## New Hampshire DOT Leading Pooled-Fund Study to Evaluate Plant-Produced High-Percentage RAP Mixtures in the NE

### Pooled-Fund Study

Many state agencies and contractors are comfortable using RAP percentages of 10-15%. However, questions about low-temperature performance and the need to bump binder grades limit the amount of HMA produced with greater than 15-20% RAP in many areas of the northeast US. A 2009 study conducted by NHDOT, UNH, and Pike Industries evaluated extracted binder properties for various batch-plant-produced HMA mixtures containing 0-25% RAP. The general conclusion was that binder bumping was not necessary at the 20% RAP level for the mixtures evaluated.

The Northeast Asphalt User/Producer Group (NEAUPG) is a non-profit association made up primarily of State DOTs and Industry, with the mission of improving the quality and performance of asphalt pavement applications in the region. The NEAUPG RAP Task Group has proposed a pooled-fund study to expand on the initial work cited above. This work will include the testing of higher-percentage RAP mixtures produced by drum and batch plants in the region. Testing of plant-produced mixtures will allow for evaluation of blending and the impact of higher RAP percentages on material properties and performance. Mixture testing will also evaluate moisture susceptibility of the mixtures containing RAP.

The proposed work will complement an ongoing FHWA evaluation being conducted by the North Central Superpave Center, and other research projects across the country. New Hampshire DOT has agreed to serve as the Lead Agency for the pooled-fund study. The project is currently in the solicitation phase through the FHWA pooled-fund website. To date, commitments have been received from New Jersey, New York, Pennsylvania, and Virginia (\$90,000 each). The FHWA has pledged \$150,000 to the project. Other New England states and North Carolina have tentatively expressed interest. The total quantity of mixes tested will be determined based on the final commitments received.

It is anticipated that this work will be accomplished through a Cooperative Project Agreement with the University of New Hampshire, with subcontracts awarded to UMass-Dartmouth and Rutgers University.

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NHDOT RESEARCH  
SECTION

## Evaluation of Alternative Technologies for Monitoring Compaction on NHDOT Projects

Nuclear density gauges (NDGs) are expensive to buy and expensive to maintain. Regulatory requirements related to radiation monitoring, training, storage, calibration and other issues place a substantial burden on State DOTs. Non-nuclear density gauges are available but suffer from issues such as a need to calibrate to specific materials, use of driven probes, and poor correlation to modern design procedures.

Some states are moving toward Light Falling Weight Deflectometers (LWDs) for QC/QA and to determine in situ properties. LWDs measure stiffness, not density, and correlate with standard FWD devices and resilient modulus data. For New Hampshire, researchers will compile a summary of other states' experiences with LWDs and related technologies (MnDOT). Three to five construction sites will be visited across NH to test two different model LWDs on typical site materials and to demonstrate the technology to contractors and field personnel. The project will include purchase of a new LWD for monitoring the stiffness of HMA. Resilient modulus testing will be completed and compared.



### New Research

## Identification of Curve Characteristics on Rural NH Roads for Cost Effective Safety Improvements

Approximately 42% of fatal crashes in New Hampshire occur at horizontal curves. Most of these are run off road accidents or lane departures, an emphasis area in the Department's Strategic Highway Safety Plan.

A number of cost-effective improvements can be made at curves to improve safety, including adding or correcting superelevation, rumble strips, paved shoulders, flattened slopes, object removal, and improved delineation and markers. Previous work by FHWA and others has demonstrated the effectiveness of such approaches; however, tools are needed to identify and prioritize curve improvements that provide the greatest benefit to NHDOT. Such tools include aerial investigations, use of the Department's data collection van (curvature, cross slope, roughness, etc.), GIS curve identification tools, and SafetyAnalyst.

This research will result in a list of curves for improvement, an HSIP systematic improvement project, calibrated safety performance functions, and crash reduction/accident modification factors.



## Establishing Limits for the use of Supplementary Cementitious Materials in Durable PCC

Maintaining quality in the production of Portland cement concrete (PCC) while reducing cost and carbon footprint is a technical issue that needs to be addressed. An effective way to do this is to maximize the use of fly ash and slag in PCC mixes used statewide. This enables the reduced production of Portland cement, a major contributor to the release of CO<sub>2</sub> in the atmosphere.



This research will provide recommendations on establishing upper limits for the use of fly ash and slag in New Hampshire. The recommendations will ensure that quality concrete relative to freeze-thaw resistance, scaling, and alkali silica reactivity is obtained while embedded carbon and release of CO<sub>2</sub> are reduced. The recommendations are expected to result in a change to the NHDOT specifications.

*“There is nothing like looking, if you want to find something.”*

*- J.R.R. Tolkien*

## Development of a Performance-Based Specification for Waterborne Traffic Paint

### CONTACT US:

NHDOT  
Bureau of Materials & Research  
PO Box 483  
5 Hazen Drive  
Concord, NH 03302-0483

Phone: 603-271-3151  
Fax: 603-271-8700  
E-mail: [groberts@dot.state.nh.us](mailto:groberts@dot.state.nh.us)

[www.nh.gov/  
dot/research](http://www.nh.gov/dot/research)

The current NHDOT pavement marking paint specification is composition-based. In response to identified issues such as drying time, durability, and other issues, a number of research reports produced in recent years have recommended that the Department convert to a performance-based specification. Such a specification would allow the Department to get the performance required while enabling the vendors to supply a product that is economical for them to produce.

This research will further investigate the advantages and disadvantages of moving to a performance-based specification, and will produce a draft procedure and specification. The fiscal and other impacts of the proposed conversion will be analyzed along with recommendations for implementation.

## Product Evaluations and other New Research

- Uretek Polyurethane Foam Injection Stabilization for Low-Volume HMA Roadways
- Poly-Carb Flexogrid Overlay
  - Concrete Bridge Deck in a Marine Environment
  - Steel Bridge Deck, Lebanon, NH - Hartford, VT
- LiftMate Frame & Lid
- Unitex Bridge Seal
- Duromaxx Reinforced HDPE Culvert
- Visilok Glass Bead Intermix System

  

- Alternative Preservative Treatments for Railroad Ties and Timbers (Synthesis)
- Performance of W-Beam Guardrail with Height Adjustment
- Investigation of Iron Bleed-Through on Waterborne Airport Traffic Paints

### Final Reports Available

- Moisture Susceptibility of Warm Mix Asphalt Mixtures
- Alternative Pavements for Snowmobile Crossings
- Mix Proportioning and Material Selection Guidelines for Self Consolidating Concrete (SCC)
- Application of the Bailey Method to NH Asphalt Mixtures
- Properties of Asphalt Mixtures Containing RAP
- In-Service Performance Monitoring of a CFRP-Reinforced HPC Bridge Deck in Rollinsford



**WHAT'S YOUR PROBLEM?**